REMARKS

In the above reference case, Claims 13-26 are pending. Applicants thank for the Examiner's thorough examination of the pending claims and thoughtful comments. Applicants will sequentially address the issues raised by the Examiner.

I. Information Disclosure Statement (IDS)

Applicants acknowledge and appreciate the comments regarding IDS made by the Examiner in page 2 of the OA.

II. The 35 U.S.C. § 103 Rejections

Claims 13-26 were rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Kakavas, P. A. "Evaluation of derivatives of the strain energy function with regard to strain invariants for carbon black-filled EPDM" (hereinafter "Kakavas") in view of Gallagher, et al., "An efficient 3-D visualization technique for finite element models and other coarse volumes" (hereinafter "Gallagher'), and further in view of Wong et al., "Combined finite element-model solution of three-dimensional eddy current problems" (hereinafter "Wong"). Applicants respectfully traverse the rejections.

A. Independent Claim 13

It is axiomatic that the combination of cited references in a §103 rejection must disclose every element in the rejected claim. MPEP 2143.03. Claim 13 is reproduced as follows:

13. A method for numerically simulating structural responses of a rubber-like material, comprising the steps of:
defining a plurality of elements and a strain-stress curve to represent the rubber-like material;
iteratively calculating a plurality of stress function $f(\lambda_i)$ values at a plurality of corresponding stretch ratios λ_i of the rubber-like material and associated stress values σ $(\lambda_i\text{-}1)$ defined in the strain-stress curve;
storing the plurality of stress function $f(\lambda_i)$ values into a stress function lookup table;

obtaining a set of principal stretches by solving eigensolution of a deformation gradient tensor at each integration point of each of the elements;
determining principal stresses in principal directions from the stress function lookup table in accordance with the principal stretches; and
transforming the principal stresses into global coordinate system. (emphasis added)

The Examiner admitted that Kakavas fails to teach gradients, lookup table and eigensolutions. (page 4 of the OA) This means that Kakavs does not teach at least the claimed steps of “storing …”; “obtaining …”; and “determining …” as recited in claim 13. Gallagher and Wong were then cited for allegedly disclosing these steps. Specifically, Gallagher for deformation gradient tensor and lookup table, Wong for eigensolutions. (page 5 of the OA) The reason allegedly asserted by the Examiner to combine Kakavas, Gallagher and Wong is that all three pieces of art are analogous since they all teach eigenvalues. (page 4 of OA)

Based on the arguments below, Applicants respectfully submit that

i) Step “obtaining ...” recited in Claim 13 is not disclosed, taught, nor suggested by Kakavas, Gallagher or Wong, viewed alone or in combination; and
ii) Kakavas, Gallagher and Wong are NOT analogous because eigenvalues are commonly used mathematical properties that can be used in many different engineering fields (e.g., electronics, optics, and many more) NOT pertinent to finite element analysis;

hence the multiple steps recited in Claim 13 are not disclosed, taught, nor suggested by Kakavas, Gallagher or Wong, viewed alone or in combination.

a. <u>Overview of Kakavas</u>

Kakavas discloses an experimental and theoretical investigation of the mechanical properties of EPDM. The Ogden equation was used for the strain energy function to <u>fit uniaxial experimental stress-strain curve</u>. Kakavas, Abstract.

1. <u>Applicants agree with the Examiner that Kakavas fails to teach gradients, lookup tables and eigensolutions</u>

   Applicants agree with the assertion made by the Examiner in lines 3-4 of page 4 of the OA. Thereby, Kakavas does not teach at least the following steps of Claim 13: "storing the plurality of stress function $f(\lambda_i)$ values into a stress function lookup table; obtaining a set of principal stretches by solving eigensolution of a deformation gradient tensor at each integration point of each of the elements; and determining principal stresses in principal directions from the stress function lookup table in accordance with the principal stretches".

b. <u>Overview of Gallagher</u>

Gallagher discloses a technique that extends exiting 3-D result visualization methods for use with discretized volumes. Gallagher, Abstract. In Gallagher, the technique accomplishes three goals in the visualization of 3-D behavior when results are available on the relatively coarse, non-uniform grid: i) the generation of smooth, non-faceted result surfaces; ii) the processing of single elements within a low-level display loop with minimal stored data; and iii) visual representation of intra-element behavior. Gallagher, Conclusions.

1. <u>No motivation or suggestion in Gallagher to combine with Kakavas, and/or Wong</u>

Gallagher teaches computer visualization that is not related to the numerically simulation of the properties of rubber-like materials as claimed in the instant application. Therefore, Applicants respectfully submit that one of ordinary skill in the art at the time the present invention was made would not have been motivated to combine Kakavas, Gallagher or Wong.

2. <u>Gallagher does NOT teach eigenvalues</u>

   Contrary to the Examiner's assertion (line 9 page 4 of OA), there is no teaching in Gallagher regarding eigenvalues at all. Applicants respectfully submit that Gallagher is not an analogous art with regard to the present invention or for that matter, prior art in the field of numerically simulating rubber-like material.

3. <u>'eigenvalues' is a commonly used mathematical property</u>

   The 'eigenvalues' is used in many different engineering fields as common mathematical property. The 'eigenvalues' as defined in a textbook by Kreyszig titled: "Advanced Engineering Mathematics" third edition published by Wiley 1972, is listed as follows:

   > Let $\mathbf{A}=(a_{jk})$ be a given square n-rowed matrix and consider the vector equation $\mathbf{Ax}=\lambda\mathbf{x}$, where λ is a number. It is clear that the zero vector $\mathbf{x}=\mathbf{0}$ is a solution of the equation for any value of λ. A value of λ for which equation has a solution $\mathbf{x}$ is not equal to $\mathbf{0}$ is called eignvalue or characteristic value of the matrix $\mathbf{A}$.

   It is evident that the 'eigenvalue' is just one of the common mathematical properties of a matrix. 'Eigenvalue' does NOT pertain to finite element analysis, rubber-like material, or the present invention described in the instant application. Therefore, Applicants respectfully disagree with the

Examiner and submit that the ‘teach eigenvalues’ should NOT be used as a reason (i.e., suggestion or motivation) to combine cited references (i.e., Kakavas, Gallagher, and Wong) in the manner proposed by the Examiner.

Even if the cited references were combined in the manner proposed by the Examiner,

4. <u>the step of “obtaining..” is not taught, disclosed nor suggested by Gallagher, Wong or Kakavas, viewed alone or in combination.</u>

   A portion of the descriptions with regard to ‘gradient’ in Gallagher is reproduced as follow:

   > “Lorensen and Cline use local gradients to produce visually smooth isosurfaces accoss the neighboring voxels, ..” (para. 1, right column, page 186 of Gallagher)

   The ‘gradients’ in Gallagher refers to the gradient of values (i.e., color intensities) to be visualized on a display screen of a computer. In other words, it is referred to the gradient of the color spectrum. This is different from the element ‘deformation gradient tensor’ recited in the step of “obtaining ..” in Claim 13 of the instant application. The deformation gradient tensor is defined as the local nature of the deformation of a solid body and is used for determination of the principal stretches at each integration point. (para. [0037] of specification) <u>The element ‘deformation gradient tensor’ in Claim 13 is NOT related to the values to be visualized at all</u>. Since “gradients” in Gallagher is different from the claimed element <u>‘deformation gradient tensor’</u>, the

combination proposed by the Examiner teaches away from the step “obtaining …”.

Therefore, Applicants respectfully submit that the step of “obtaining a set of principal stretches by solving eigensolution of a deformation gradient tensor at each integration point of each of the elements” is not disclosed, taught, nor suggested by Kakavas, Gallagher or Wong, viewed alone or in combination, even if the combination in the manner proposed by the Examiner were valid.

c. Overview of Wong

Wong discloses the reliability of finite element methods used for modal analysis of two and three-dimensional eddy current problem (i.e., a study of reliability of a solution in fluid dynamics, which has no relation whatsoever with the rubber-like material). Wong, Abstract. Wong also discloses the root cause for unstable solutions in the finite element analysis of the vector wave equations. Wong, Conclusion.

1. No motivation or suggestion in Wong to combine with Kakavas, and/or Gallagher

   Wong teaches a computational fluid dynamics technique to solve a physical phenomenon – eddy current, which is not related to the numerically simulation of the properties of rubber-like materials as claimed in the instant application. Also the teachings in Wong are not related to the computer visualization techniques disclosed in Gallagher. Applicants respectfully submit that one of ordinary skill in the art at the time the present invention was made would not have been motivated to combine Kakavas, Gallagher or Wong.

2. ‘eigenvalues’ is a commonly used mathematical property

Applicants wish to apply the above remarks stated with regard to the same sub-title under Overview of Gallagher. Therefore, Applicants respectfully submit the ‘teach eigenvalues’ should NOT be used as a reason to classify cited references (i.e., Kakavas, Gallagher, and Wong) as analogous for a combination in the manner proposed by the Examiner.

Even if the cited references were combined in the manner proposed by the Examiner,

3. <u>the step of “obtaining..” is not taught, disclosed nor suggested by Wong, Gallagher or Kakavas, viewed alone or in combination</u>
   Wong teaches a root cause of instabilities of eigensolution of the vector wave equation, which is different from the <u>eigensolution of deformation gradient tensor</u> as recited in Claim 13. First, eigensolution in fluid dynamics dislosed in Wong is different from eigensolution of a deformation gradient tensor as recited in Claim 13. Second, there is NO instability problem in solving deformation gradient tensor. Therefore, Applicants respectfully submit that the step of “obtaining a set of principal stretches by solving eigensolution of a deformation gradient tensor at each integration point of each of the elements” is not taught, suggested, or motivated by Kakavas, Gallagher or Wong, viewed alone or in combination, even if the combination in the manner proposed by the Examiner were valid.

Based on the above remarks, Applicants believe the currently Claim 13 shall be allowable over the cited references. Reconsideration of Claim 13 is respectfully requested.

B. Independent Claims 21 and 24

Independent Claims 21 and 24 incorporate similar features recited in Claim 13 and were also rejected for the similar reasons as for Claim 13. Applicants would like to apply the above remarks for Claim 13 to support Claims 21 and 24 also. Reconsideration of Claims 21 and 24 is respectfully requested

C. Dependent Claims

Dependent claims 14-20 are dependent upon claim 13, claims 22 and 23 are dependent upon claim 21, claims 25 and 26 are dependent upon claim 24, and contain additional limitations further distinguish them from Kakavas, Gallagher or Wong, viewed alone or in combination. Therefore, Claims 14-20, 22, 23, 25 and 26 shall be allowable for at least the reasons stated above with regard to independent claim 13.

III. *prima facie* Case of Obviousness

A portion of the section 706.02(j) of the MPEP is reproduced as follows:

> 35 U.S.C. 103 authorizes a rejection where, to meet the claim, it is necessary to modify a single reference or to combine it with one or more other references. After indicating that the rejection is under 35 U.S.C. 103, the examiner should set forth in the Office action:
>
> (A) the relevant teachings of the prior art relied upon, preferably with reference to the relevant column or page number(s) and line number(s) where appropriate,
>
> (B) the difference or differences in the claim over the applied reference(s),
>
> (C) the proposed modification of the applied reference(s) necessary to arrive at the claimed subject matter, and
>
> (D) an explanation why one of ordinary skill in the art at the time the invention was made would have been motivated to make the proposed modification.
>
> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a

> reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art and not based on applicant's disclosure. *In re Vaeck,* 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).
>
> The initial burden is on the examiner to provide some suggestion of the desirability of doing what the inventor has done. "To support the conclusion that the claimed invention is directed to obvious subject matter, **either the references must expressly or impliedly suggest the claimed invention or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references."** *Ex parte Clapp*, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985).

(emphasis added)

Applicants respectfully submit that the Examiner did not present a convincing line of reasoning in the OA. The only assertion is as follows: “the three pieces of art are analogous since they all teach eigenvalues” (page 4 of the OA). Applicants assert that Kakavas (i.e., rubber-like material), Gallagher (i.e., computer visualization), and Wong (i.e., computational fluid dynamics) teach unrelated subject matters and they should not be combined in the manner proposed by the Examiner.

If the Examiner were to maintain the same103 rejections, Applicants respectfully request that the Examiner specifically point out the suggestions and/or motivations to combine the cited references.

Summary

In view of the forgoing, Applicants believe that all claims now pending in this application are in condition for allowance. Early and favorable action is being respectfully solicited.

If there are any issues remaining which the Examiner believes could be resolved through either a Supplementary Response or an Examiner's Amendment, the Examiner is respectfully requested to contact the undersigned at (408)255-6853.

No fee is required for this amendment, if it is determined that a fee is due in connection with this paper, the Commissioner is hereby authorized to charge payment of any fees associated with this communication or credit any overpayment, to Deposit Account No. 553308, including any filing fees under 37 CFR 1.16 for presentation of extra claims and any patent application processing fees under 37 CFR 1.17.

I hereby certify that this correspondence is being transmitted to the Commissioner for Patents electronically on the date stated below.

Date: Nov. 29, 2006

Signature: /Roger H. Chu, Reg.# 52745/
Roger H. Chu

Respectfully submitted,

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